INFRARED, INC.

TECHNOLOGY DEMONSTRATION FACT SHEET

Non-Intrusive Liquid Level Detection System

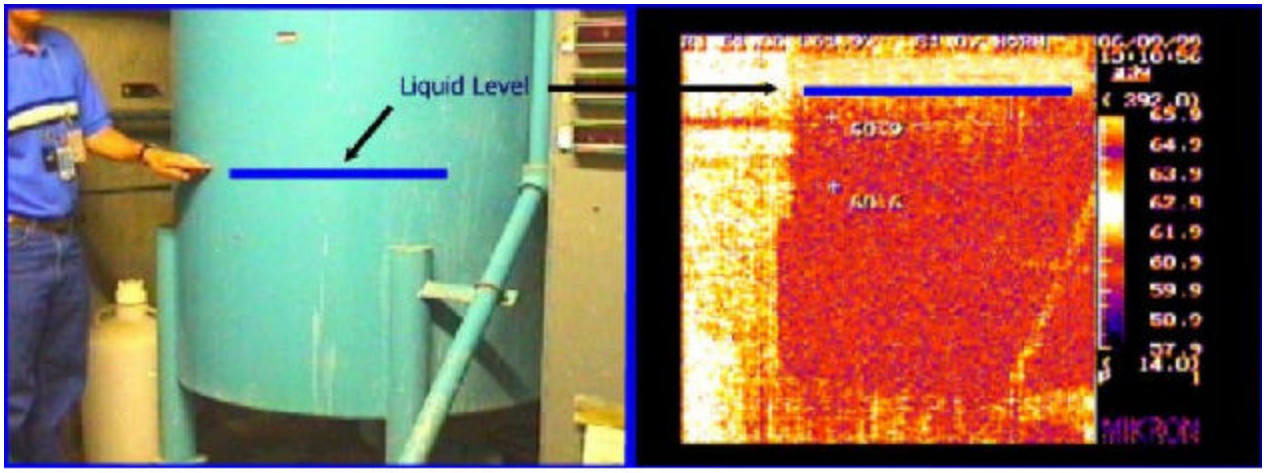
SUMMARY

During June and July of 1999 Infrared Inc. of Reno Nevada successfully demonstrated a Non-Intrusive Liquid Level Detection System (NLLDT). The NLLDT Systems provides an attractive alternative to the baseline technology that employs mechanical methods of opening tanks, vessels and piping assemblies to detect liquids or other foreign materials. An Infrared Imaging Systems is able to exploit the variations in physical properties of tanks, vessels and piping systems and the enclosed liquid and air to produce clearly defined locations of liquids, if they exist. For decontamination and commissioning (D&D) projects, the NLLDT System can be used to remotely locate liquids in vessels while providing optimum safety from radiation and contaminates for the operators. This demonstration was conducted with the goal of characterizing a number of target vessels located at the Hanford site on the canyon deck of the 221 U facility. This technology is suitable for DOE nuclear facilities D&D sites or similar public or commercial sites that must be decommissioned.

INNOVATIVE TECHNOLOGY DESCRIPTION

All matter – animate or inanimate, liquid, solid, or gas constantly exchanges thermal energy in the form of electromagnetic radiation with its surroundings. The differences in the physical properties of various materials will result in temperature variations that can be detected using infrared cameras. Thermography is the process of converting this emitted heat into a visible dynamic TV-like picture. By creating a detailed two-dimensional temperature pattern (thermogram) of the surveyed surface, information on temperature is obtained from several thousand points in the field of view of the scanner, or detector array, in about one thirtieth of a second. A typical thermographic scanning unit produces a thermal image 30 times each second detecting temperature differentials as low as 0.2°C at ambient temperature.

All infrared-imaging cameras consist of at least five basic parts, optical components, filter, detector, electronics, and temperature display. Two Infrared Imaging Cameras were utilized in the demonstration of the detection of liquid levels in tanks and piping. Both cameras are full color radiometers and operate in the 3 to 5 and 7 to 14 micron wavebands respectively.



BASELINE TECHNOLOGY DESCRIPTION

The current method for determining the existence of liquids or other foreign materials in tanks, vessels or piping assemblies is to conduct a mechanical visual inspection. Following is listed the steps that are required to conduct such an inspection in a radiologically hazardous environment:

- Develop work package.
- Build scaffolding around the tank or vessel
- Remove flanges and or other access devices
- In the case of piping assemblies insert hot-tap
- Measure vapor or gasses that may emanate from the vessel or liquids from the hot-tap
- Perform visual inspection, physically check for liquid levels.
- Replace flanges or other entry access devices
- Remove scaffolding

The safety and hazard problems associated with the inspection would include, unsafe air space in the equipment, potential contact with unknown liquids, fall hazards associated with the scaffolding, heat stress from physical exertion and additional radiation doses to workers due to exposure of the tank or vessel.

DEMONSTRATION DESCRIPTION

The purpose of the demonstration was to evaluate the capability of the NLLDT System to detect liquids in a number of selected targets. Ten target vessels and a number of piping assemblies located on the canyon deck of the 221-U facility were selected for evaluation.

The demonstration factors included:

- Capability to detect liquids or other foreign matter in vessels and piping assemblies
- Capability to operate in a radiologically contaminated environment and to (perform the demonstrations in such a way as to) avoid contamination
- Easy to decontaminate with conventional practices
- Capability of the computer and software to analysis data

Infrared and visual cameras were positioned to capture a timed sequence of approximately 30 images per target. When required, external heat was applied to force temperature gradients. Images were analyzed using computer software to characterize the tanks or piping assemblies.

PERFORMANCE SUMMARY

The following table summarizes the performance and operation of the NLLDT System compared to the baseline technology.

Feature	NLLDT	Baseline
Average Setup	30 min.	7.9 hours
Inspection	30 min.	24 hours
Cost Tanks	$600	$3600
Cost Piping	$115	$1000
Safety	Moderate	Potentially Large

DETAILS OF BENEFITS

The use of the NLLDT System to detect liquids in vessels and pipes eliminates the need to physically open and inspect these vessels. Risks to workers associated with gaining access to these type objects and the possible exposure to radioactive or contaminated materials can nearly be eliminated

FUTURE APPLICABILITY

- The NLLDT System is suitable for DOE nuclear facility D&D sites or any other sites that must be surveyed to facilitate property transfer or release.
- The technology is useful for site characterization in support of D&D engineering design and during and subsequent to D&D activities.
- Use of the technology inherently reduces the exposure of personnel to radiological hazards

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